Community Solar Action Plan

for

the Town of Montague

Photo Credit: *Town of Montague*

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Completed using the *Community Planning for Solar* Toolkit available at https://ag.umass.edu/solarplanning

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Executive Summary

The intent of this *Community Solar Action Plan* is to help guide future solar development within the Town of Montague by providing specific actions town residents and officials can take to develop solar on municipal properties, promote solar on residential and commercial properties, encourage solar development on locations preferred by the community, and adopt bylaw amendments and permitting processes in line with resident preferences. This Action Plan is a result of a thorough planning process, which included an assessment of community solar resources and infrastructure, distribution of a community solar survey, and based on these activities, development of this Plan. This process followed the steps outlined in the *Community Planning for Solar* Toolkit which is available on the UMass Clean Energy Extension website (http://ag.umass.edu/solarplanning).

The Town of Montague has been impressively proactive in pursuing solar development on municipal properties, including working with a developer to install solar on several former landfill properties and exploring opportunities for a microgrid. There are additional steps the town can take to continue to expand these efforts on developed or disturbed sites owned by the town.

Montague residents who responded to the community solar survey (click here for survey summary) are highly supportive of solar development on previously disturbed and developed sites, while supporting little or no development of agricultural land and natural, undeveloped spaces. This Action Plan is based around goals supported by solar survey respondents, including achieving community self-sufficiency from solar, which would require roughly 150 MW of solar capacity, as well as exploring additional solar development to help meet state goals (160 MW). Community self-sufficiency could partially be accomplished through development of previously disturbed and developed spaces, although some limited development of undeveloped land would be required to meet this goal. Major solar assets include large rooftops and parking lots owned by businesses, institutions, and farms, many of which are located near three-phase lines in downtown Turners Falls and could safely connect to the grid. Residential rooftops and yards could also contribute a significant fraction (as much as one-quarter) of the town's future electricity needs. This Action Plan calls for outreach to residents, businesses, institutions, and farms to encourage solar development on these locations.

Montague has several gravel pits, as well as large sections of electricity transmission right-of-ways (ROWs) which could be explored for solar development. There is also some potential for development along major roads or near existing development. This Action Plan recommends bylaw updates to expand the potential for large solar development on these types of sites, while also imposing more specific restrictions on solar on agricultural or natural lands. While solar survey respondents are open to agrivoltaic systems or solar arrays deployed between farm fields, most agricultural areas are located away from three-phase lines and could not support large solar developments. Some natural areas near three-phase lines could be at risk of solar development, and conservation options could be considered in these areas.

Terms, Abbreviations, and Acronyms used in the Plan

Terms

Photovoltaic, or "PV," systems are solar arrays composed of panels that generate electricity from sunlight. These panels are a different type of technology than the types of panels used in "solar hot water" or "solar thermal" systems.

Voltage of an electric power line can be thought of as the equivalent of pressure in a water line. The voltage of transmission and distribution power lines is typically measured in kilo-volts (kV). One kilo-volt is equivalent to 1000 volts (V). In residential use in the United States, electrical wires within a household carry electricity at 120 V.

Capacity of a solar array is a description of the instantaneous power output of the panels at top production (i.e, in full sun). It is typically measured in kilowatts (kW) or megawatts (MW). One MW is equivalent to 1,000 kW. A residential-size solar system is typically 5-10 kW in capacity. Commercial-scale solar arrays are typically 1 MW or greater in size. An average 1 MW array would cover approximately 4-5 acres of land.

Annual generation of a solar array is a measure of the yearly energy output produced by the panels. It is typically measured in kilowatt-hours (kWh) or megawatt-hours (MWh). In New England, annual generation is approximately equal to the array's capacity (in DC) *14% * 8,760 hours per year.

DC is the abbreviation for direct current, the type of electricity produced by solar panels. The DC capacity of a solar array is a good indication of its size, and footprint on the landscape.

AC is the abbreviation for alternating current, the type of electricity flowing into the grid from a solar array, after it has gone through a transformer. In the absence of energy storage, a typical DC to AC ratio for solar array capacity is about 1.25:1. However, with energy storage, that ratio can be significantly higher (close to 2:1). Since excess electricity can be stored in batteries during the day, and released into the grid during the night when the panels are not generating electricity, the AC electricity input that the grid "sees" is lower than it would be if all electricity converted from DC were directly flowing into the grid.

SMART is the abbreviation for the current state solar energy incentive program (the Solar Massachusetts Renewable Target program). This program replaced earlier solar incentive programs, commonly known as "SREC" programs, in November of 2018, and was further updated through an emergency regulation in April 2020. The SMART regulation includes incentives for projects up to 5 MW AC in size. Additional incentives are available for projects located on buildings, parking lot canopies, landfills, brownfields, and "dual-use" solar and agriculture projects, as well as certain types of projects that benefit public entities, like municipalities. The updated regulation places restrictions on what types of large, ground-mounted projects can receive incentives, if they are sited on undeveloped land designated as BioMap2 Critical Natural Landscapes or Core Habitat, by the state MassWildlife Natural Heritage and Endangered Species Program.

Microgrids are local electricity networks with a local source of supply (e.g., solar PV) and often energy storage. They are typically attached to the larger electric grid but are also able to function independently.

Abbreviations & Acronyms

CEE - UMass Clean Energy Extension
DOER - Massachusetts Department of Energy Resources
FRCOG - Franklin County Regional Council of Governments, the regional planning authority for Franklin County, MA
kV - kilo-volt
kW - kilowatt
kWh - kilowatt-hour
MDAR - Massachusetts Department of Agricultural Resources
MVP - Municipal Vulnerability Preparedness plan, a municipal planning document
MW - megawatt
MWh - megawatt-hour
OSRP - Open Space and Recreation Plan, a municipal planning document
PV – photovoltaic, the type of solar panels that generate electricity from sunlight
sf - square feet

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1. INTRODUCTION

1.1 Purpose

The intent of this *Community Solar Action Plan* is to help guide future solar development, municipal bylaw amendments, and solar permitting decisions within the Town of Montague. This plan also includes recommendations regarding specific activities to develop solar on municipal properties, campaigns to promote solar on residential or commercial properties, and next steps to encourage solar development on locations preferred by the community.

1.2 Planning Process

This draft *Community Solar Action Plan* was composed for the Town of Montague by UMass students Victoria Haskins and Caroline Williams and UMass Clean Energy Extension staff, as part of a two-semester, service-learning class at the University of Massachusetts Amherst, in which UMass undergraduates partnered with local communities to conduct a proactive, community-oriented solar planning process.

The draft *Community Solar Action Plan* developed through this project is the result of a thorough planning process, which included 1) an assessment of community solar resources and infrastructure, 2) development of town-specific solar development alternatives, 3) distribution of a community solar survey and analysis of survey results, and finally, based on these activities, 4) development of this draft *Community Solar Action Plan*. This process followed the steps outlined in the *Community Planning for Solar* Toolkit which is available on the UMass Clean Energy Extension website (http://ag.umass.edu/solarplanning).

Before the *Community Solar Action Plan* is finalized, it will undergo review by municipal representatives involved in the project through the Solar Planning Committee and members of other relevant municipal boards (e.g. Select Board, Planning Board, Conservation Commission). It will be presented to community residents at a community forum, with the opportunity for residents to provide feedback. These review processes are expected to result in revisions which will improve the clarity, content, and implementation of the plan. The planning process was initiated in September 2022, the community survey was conducted in March-May 2023, and the community forum is expected to occur in fall 2023.

Because Montague is one of the first towns to complete this planning process via collaboration with UMass students and staff, **we welcome and encourage comments not only on the town-specific content contained within this draft *Community Solar Action Plan*, but also on the scope, organization, and readability of information contained within this plan**. This more general feedback will help us to develop final deliverables and examples that provide greater clarity and utility for municipal representatives and community residents in towns across the state who participate in this planning process.

1.3 Community Goals & Plan Structure

Montague residents in general are strongly motivated to combat climate change and supportive of solar development. Based on the *Community Solar Survey,* 91% of residents are "extremely" or "moderately" concerned about climate change, and 90% reported they have a "positive" or "very positive" attitude towards solar development.

Montague survey respondents are most supportive of solar development on already developed spaces like roofs and parking lots. A majority indicated support for developing all available gravel pits and quarries (60%), parking lots (82%), large rooftops (84%) and landfills and brownfields (86%). A majority of residents were also supportive (69%) or neutral (16%) regarding a goal of solar development sufficient to meet community needs. There was also significant support for solar development to meet anticipated regional (67%) or state (57%) needs. Montague residents are also concerned about conservation of undeveloped natural and agricultural lands within town and showed little support for developing these landscapes for solar – a majority indicated they would like to see no agricultural or natural lands developed for solar. On average, 9% of natural lands and 14% of agricultural lands were preferred to be developed for solar.

With these results in mind, this Plan focuses on strategies and actions designed to aid in development of currently developed spaces and disturbed lands for solar, as well as exploring additional ground-mounted solar development which would be necessary to meet a goal of community self-sufficiency or to support state goals for solar development. Based on our analysis, community self-sufficiency might ultimately require approximately 150 MW of solar development in Montague, 8.5x the current amount of solar installed. This estimate is based on future projections of energy use by 2050, including a transition from fossil fuel-powered vehicles to electric cars, and from traditional heating sources to renewable sources. Our estimates suggest this might require development of 475-675 acres of undeveloped land. To help support state electricity needs, Montague would need to develop slightly more solar – roughly 4% of its land area, or about 525-800 acres. This would equate to 160 MW of solar, 9x Montague's current solar capacity. *[Note that these are estimates based on rough projections of future electricity needs and electricity sources. Future technological advances, land use decisions, and changes in population, community infrastructure, or energy use can be expected to lead to modifications to these estimates. It is anticipated that this plan and the calculations included herein will be revisited and updated regularly.]*

Meeting a goal of community self-sufficiency or supporting state electricity needs will require active efforts to deploy solar on developed spaces, disturbed lands, and other sites acceptable to the community. This plan is designed to help guide these efforts.

Discussions of solar development options are divided into five categories – residential, municipal, local business/institution, on-farm, and large, ground-mounted solar on private land. Within each category, we discuss the current status of existing solar capacity, community perspectives, the future potential for solar development, potential next steps, and specific action items.

Following the sections addressing solar development options is a section addressing the existing solar bylaw and how the bylaw and permitting processes could be updated to better reflect community attitudes expressed in the solar survey.

Finally, the plan concludes with a summary of action items and the anticipated timeline for when this plan will be revisited and revised.

1.4 Planning Process Documents

The final *Community Solar Action Plan* will be made available as an example on the UMass Clean Energy Extension website.

The *Community Solar Action Plan* will also be made available on the town website (https://montague-ma.gov/g/79/Solar-Planning-Committee). Additional documents developed as part of the planning process (e.g. the *Solar Resource & Infrastructure Assessment*, the *Community Solar Survey Results Summary*) will also be made available on the town website.

2. MUNICIPAL SOLAR

This section addresses solar on municipal building rooftops, municipal parking lots, and municipal properties, including public schools located within the community.

2.1 Current Status

Existing Infrastructure & Electricity Use

Montague has 12 municipal facilities which are currently listed in the town's Green Communities report. The largest electricity users, from highest to lowest, are the Clean Water Facility (aka Water Pollution Control Facility), Sheffield Elementary School, the DPW Garage, the Town Hall, Hillcrest Elementary, Colle Opera House, Shea Theater, the Carnegie Library, the Airport Office, the Millers Falls Library, the Montague Center Library, and the Parks and Recreation Fieldhouse. Additional municipal locations that use small amounts of electricity are street and traffic lights.

The town utilizes 1,486 MWh per year of electricity to supply these municipal facilities. A solar capacity of 1,143 kW (1.1 MW) would be required to generate an equivalent amount of electricity annually.

Several public buildings that are shared with other municipalities or managed by special districts are not included in the estimated energy use above. These include: of and their energy use is not included above:

Great Falls Middle School and Turners Falls High School are located in Montague, but these regional schools are shared with the Town of Gill. Montague is partially responsible for the energy consumption of these buildings. Energy bills for these buildings are managed through the school district. In addition, the Franklin County Technical School is also located in Montague, accepting students from most towns in the county.

The following buildings are managed by special districts on behalf of the community. These include:

- The Turners Falls Fire Station is owned by the Turners Falls Fire District.
- The Montague Center Fire Department is owned by the Montague Center Fire District.
- The Turners Falls Water Department Buildings are owned by the Turners Falls Fire District.

The town has several solar arrays located on municipal land. There are three solar arrays on a former dump site south of Turnpike Road, near Sandy Lane. The first two arrays to be built together comprise a 6.0 MW DC project located at 10 Sandy Lane. This project came online in 2018 and has a PPA with Town of Montague. An additional 3.0 MW DC project located on municipal property at 12 Sandy Lane came online in 2021. This project includes a small parking canopy and a ground-mounted solar array located over the footprint of a former landfill. The town also owns a 32 kW system which came on-line in 2020. There is no current energy storage on town property.

The town purchases 24% of the power generated by the larger array in net metering credits. This is roughly equivalent to the annual electricity usage of all town buildings

included in Montague's annual Green Communities report. However, as described above, not all public buildings are included in Montague's Green Communities report.

Current Regulatory Status

In Montague, rooftop solar is considered a building-mounted system; it can be any size and is allowed by right in all zoning districts. The wording of the town bylaw is somewhat confusing. The building-mounted definition states:

A solar energy installation that is permanently affixed to a building, as defined by the building code. ***This definition is inclusive of canopy structures.*** [emphasis added]

Based on consultation with municipal staff, this definition is intended to include solar canopies over parking lots, in addition to canopies extending out from the building. However, the language is somewhat unclear and could be clarified (see *Potential Next Steps*).

Community Perspectives

Montague residents showed strong support for solar development on municipal buildings and properties. In the *Community Solar Survey*, 86% of respondents indicated they felt the town should invest in solar development on municipal buildings and parking lots to meet municipal needs. An additional 11% of residents were supportive of municipal development, depending on certain factors. Some of the factors cited include where the panels would be located and how much it would cost. Respondents were concerned that the town would not have enough money to finance these projects.

In addition, 76% of residents were supportive of town investment in solar projects to support town-wide community electricity needs, with an additional 18% supportive dependent on certain factors, similar to those listed above.

Additional results relevant for municipal solar considerations:

- Most *Solar Survey* respondents are very likely (54%) or likely (35%) to support solar projects that provide back-up power for schools and emergency shelters.
- Most *Solar Survey* respondents support (26%) or strongly support (61%) solar development on former landfills.

2.2 Future Potential

Future Electricity Use

Based on current fossil fuel use (heating oil, natural gas) to heat town buildings, we estimate roughly 986 MWh of electricity would be needed to heat municipal buildings with air-source heat pumps. In addition, if all municipal vehicles were to be converted to electric, an additional 470 MWh is estimated to be needed as an alternative to gas and diesel. Under this scenario, municipal electricity use would roughly double to 2,942 MWh, necessitating 2,263 MWh (2.3 MW) of total solar capacity to meet municipal needs.

These totals do not include electricity use by Great Falls Middle School, Turners Falls High School, the Gill-Montague special education facility, Franklin County Technical School, Turners Falls Fire Station, Montague Center Fire Department, or Turners Falls Water Department Buildings. Also not included is potential future electricity use by school buses,

which are currently run on fossil fuels and owned and operated by a private company. Both the state (https://www.masscec.com/program/notice-intent-accelerating-clean-transportation-school-bus-actbus) and federal government (https://www.epa.gov/cleanschoolbus) have recently begun providing competitive funding and/or technical support for the deployment of electric school buses.

Potential Energy Storage Locations

Montague's Public Safety Complex (180 Turnpike Road) in Turners Falls houses the town's Police and Fire Department Headquarters. It was the subject of a recent study to determine the feasibility of constructing a microgrid, powered with solar electricity. This building has generators, but they only cover the basic needs of the building (light and heat). It would be advantageous to add a solar plus energy storage facility, to provide an additional source of back-up power to ensure emergency services are functional during an outage. A newer DPW Garage is located just down the road from this building. There has also been discussion of connecting a Public Safety Complex microgrid to Turners Falls High School, located just 0.4 miles away on the same street.

Turners Falls High School (222 Turnpike Road) serves as a regional emergency shelter. It also houses radio equipment for communication during an emergency. The building has natural gas heat, a back-up oil system, and generators. However, according to the town's Municipal Vulnerability Preparedness (MVP) Plan, Montague would be among the first locations to be cut off during times of insufficient natural gas supply. In addition, the High School boiler loses gas pressure during very cold weather and cannot operate. The backup oil system can only run for one day. With this in mind, connection to a Public Safety microgrid, or incorporation of a separate solar plus energy storage facility, would be of great value to the town and community in the event of an emergency.

Other Potential Emergency Shelter Sites. Given that the Town of Montague covers a large area, it might be advantageous to the community also to have emergency shelter locations in other villages within the town. While much of Montague's municipal infrastructure is located in Turners Falls, there are libraries located in two other villages– the Millers Falls Library (23 Bridge Street) and Montague Center Library (17 Center Street). These or other larger public facilities (such as the Montague Center Fire Station) could be considered as potential energy storage sites, serving as more localized emergency shelters. Energy storage can also reduce electricity costs at buildings with relatively high electricity use.

Clean Water Facility (aka Water Pollution Control Facility). This plant provides vital sewage treatment services to the town. While it has back-up power, a solar plus energy storage facility would provide additional resiliency during a power outage.

Municipal Rooftops

The largest roofs on public buildings are Franklin County Technical School, Turners Falls High School and a foreclosed property now owned by the Town of Montague (**Table 1**). The only rooftop that is solar ready is the Department of Public Works building, which was built within the last five years.

Structure/Ownership Status	Street Address	Total Roof Area (sf)	Estimated Technical Solar Potential (kW)
Franklin County Technical School	82 Industrial Blvd	154,104	1,511
Turners Falls High School	222 Turnpike Rd	93,048	913
Foreclosed Property (owned by Town of Montague)	20 Canal Rd	49,589	486
Sheffield Elementary School	40 Crocker Avenue	45,506	446
Hillcrest Elementary School	30 Griswold St	34,544	339
Department of Public Works	128 Turners Falls Rd	28,804	282
Shea Theater/Crocker Cutlery Apartments	61 Third St	27,254	267
Turners Falls Water Department	226 Millers Falls Rd	26,310	258
Public Safety Complex	178 Turnpike Rd	22,971	167
Turners Falls Airport	36 Industrial Blvd	14,592	106
DPW Garage	500 Avenue A	12,722	93
Town Hall	1 Avenue A	11,881	87
Turners Falls Airport	Millers Falls Rd	9,369	68
Water Treatment Facility (Town of Montague)	34 Greenfield Rd	8,714	63
Sheffield Elementary School	35 Crocker Ave	8,081	59
Fire Station	28 Old Sunderland Rd	8,065	59
Turners Falls Airport	36 Industrial Blvd	6,939	51
Warehouse (Town of Montague)	20 Canal Rd	6,742	49
Water Treatment Facility? (Town of Montague)	92 Green Pond Rd	6,025	44

Table 1. Publicly owned properties with large areas of roof available for solar.

Other town buildings with roofs over 5,000 sf in area include the two elementary schools (Sheffield and Hillcrest), the Shea Theater, water treatment facilities, Turners Falls Airport buildings, the DPW Garage, the Town Hall, and one of the town's fire stations. Colle Opera House, the three libraries (Carnegie, Millers Falls, and Montague Center), and the Parks & Recreation Fieldhouse all have roofs smaller than 5,000 sf. These sites may not be economically viable for solar production but could still be considered in an on-site evaluation of municipal buildings.

Our estimate of solar potential on municipal roofs over 5,000 sf is 5,348 kW (5.3 MW). This is the technical potential, and does not take into account roof condition or shading. All of these locations would require on-site evaluations to understand actual solar potential.

Solar arrays over 50 kW in size often must connect to three-phase electricity distribution lines to interconnect to the electricity grid safely. All of the large municipal rooftops which could accommodate an array over 50 kW in size are located near three-phase lines.

Municipal Parking Lots

A number of municipal locations also have paved areas which could be appropriate for solar. The locations with the largest parking lots include several schools - Turners Falls High School, Franklin County Technical School, Sheffield Elementary, and Hillcrest Elementary. These all have large parking lots. The airport also has large, paved areas (aside from the runway), but it is possible glare could be an issue if solar were put at this facility.

Parking lots can have a packing density of approximately 263 kW per acre; the estimates of technical potential provided below are based on this figure.

Location/Ownership Status	**Approximate Area** (sf)	**Estimated Solar Technical Potential** (kW)
Turners Falls High School	4.00	1,052
Franklin County Technical School	3.00	789
Sheffield Elementary School	2.75	723
Turners Falls Airport	2.30	605
Town Hall	1.32	347
Montague Community Television	1.19	313
Public Safety Complex	1.00	263
Hillcrest Elementary School	1.00	263
Unity Park Parking Lot	0.91	224
Transfer Station/Recycling Center	0.50	132

Table 2. Publicly owned properties with large areas of roof available for solar.

Our estimate of total technical potential on municipal parking lots is 4,711 kW (4.7 MW). However, this is the technical potential. This estimate does not take into account driveways, logistics, economic considerations, or other considerations, and hence is likely a significant overestimate of actual potential. All of these locations would require on-site evaluations to understand use patterns, available space, and actual solar potential.

Solar arrays over 50 kW in size often must connect to three-phase electricity distribution lines to interconnect to the electricity grid safely. All the parking lots in **Table 2** which could accommodate a solar array are located near three-phase lines.

Ground-Mounted Solar

The town has former landfill and burn dump areas south of Turnpike Road, near Sandy Lane. Portions of these sites have already been developed for solar, but additional development in this vicinity is possible. The site is adjacent to three-phase power.

The town has also been exploring siting a battery storage system placed in the Canal District - specifically on the former Strathmore/Indeck properties at the north end of the island within the canal. This site is a 3-acre parcel owned by the town and is located adjacent to three-phase power. Solar at this site is also likely feasible. However, there are a number of challenges at the site, which could be cost-prohibitive. These include the need to fully demolish remaining structures at the site before introducing new infrastructure, as well as current issues with interconnection capability.

According to the Massachusetts Department of Environmental Protection (MassDEP), there are also four brownfield locations in Montague that are all town-owned. Montague's brownfields are listed in **Table 3** below. In total there are 4.5 acres of identified brownfields located in Montague. If found in town, additional previously developed areas contaminated by hazardous materials could also qualify as brownfields. In total, these areas represent roughly 900 kW (0.90 MW) of potential solar development.

Former use	Current use	Address	Approximate Area (acres)
Paper mill	Town-owned, seeking re-development	20 Canal Street	1.90
Residential	Residential	East Main Street	1.73
Vacant lot	Vacant lot	2 Third Street	0.45
Commercial	Unlisted	Second/Third Street	0.42

Table 3. Brownfields located in Montague, as identified by MassDEP.

Financial Considerations

Development of solar on municipal buildings and land can be simpler in some ways than development on private land because town boards have the greatest control over determining whether these projects proceed. However, towns do not always have funding available to pay for solar projects.

Financial costs and benefits of municipal solar are dependent on many factors, including system size, system cost, electricity rates, solar incentives, federal and state tax credits, loan amount, and loan terms (interest rate, term). All of these items are site-dependent, and subject to change over time. Historically, municipal governments were unable to receive federal or state tax credits for solar development, which could make these projects more challenging from a financial perspective. However, with the recent passage of the federal Inflation Reduction Act, organizations that do not owe taxes now are eligible for a "direct payment" option, which can cover 30% of the costs of a new solar installation. This change will make small to medium-size municipally owned solar projects more financially viable. Depending on the size, location, and type of system, new solar arrays may also be eligible for solar incentives through the state SMART program on a fixed $/kWh basis; this program has a specific additional incentive for "public" projects owned, operated, or benefitting the municipality. Alternatively, the town can earn Renewable Energy Credits for each MWh of solar energy that is generated. Some financial institutions offer loans which can be applied to solar projects or may offer specific solar loans designed to cover the costs of new solar arrays. UMass CEE can assist the town with calculations of the costs and savings associated with specific municipal solar projects.

The Commonwealth of Massachusetts is strongly supportive of solar development on former landfill sites. Projects on former landfills and brownfield sites are eligible for additional SMART incentive "adders" over and above base compensation rates, on the order of 3-4 cents per kWh. The Massachusetts Department of Environmental Protection (MassDEP) also has a website and set of guidance documents related to development of former landfill sites (https://www.mass.gov/siting-clean-energy-at-closed-landfills).

2.3 Next Steps & Action Items

Potential next steps for municipal solar development include:

- Install solar on Town Hall Annex roof, with ARPA funds committed to this project.
- Start planning for a solar installation on the Department of Public Works roof because this roof is already solar-ready.
- Conduct on-site evaluations of solar potential on municipal rooftops with the assistance of a solar installer. At minimum, the following sites should be included: Franklin County Technical School, Turners Falls High School and Great Falls Middle School, the two elementary schools (Sheffield, Hillcrest), the Turners Falls Water Department, the Public Safety Complex, the Town Hall, and Millers Falls Library. The Montague Center Library could also be considered if the slate roof is replaced. Evaluations should include rough quotes for installation cost and identify potential obstacles to development (e.g., roof warranties, roof structure, interconnection). The evaluations at the Turners Falls High School and Great Falls Middle School, the Turners Falls Water Department, the Public Safety Complex, and the libraries should include energy storage options to support emergency shelters or back-up power at the facilities.
- As part of on-site evaluations, include assessments of parking lot canopies at the schools, Town Hall, and Public Safety Complex.
- Determine if additional municipal roofs or parking lots should be included in the priority list noted above.
- Determine whether alternative local shelter sites, such as the Montague Center Fire Station, would be preferable to the libraries, in villages outside of Turners Falls.
- Conduct an on-site evaluation to determine how much more of the former landfill site on Turnpike Road could be developed for solar.
- Conduct an evaluation of solar potential at the Canal District site. This should include an assessment of battery storage opportunities.
- Determine whether brownfields in Montague should be considered for re-development.
- Set up a Mass Energy Insight (MEI) account for Montague to facilitate tracking of town energy use data.
- Work with school staff to compile and analyze energy usage at Turners Falls High School and Great Falls Middle School in MEI.
- Work with school staff to compile and analyze energy usage at Franklin County Technical School.
- Continue exploration of the microgrid opportunity at the Public Safety Complex, with possible extension to the High School.
- Explore potential options to support solar development aside from direct use of town funds (e.g., ARPA funds, MVP grants, solar loans).

- Carry out financial analyses to understand costs and benefits of specific solar options (UMass CEE can assist).
- Complete a table to plan for future development, e.g.:

Building/ Location	Address	Solar Potential	Rough Cost ($)	Roof Warranty Information	Roof Structural Needs/ Cost	Energy Storage Needs?	Funding Sources ?	Anticipated Year for Development?

- Explore potential for electric buses and associated charging needs for the elementary schools, Great Falls Middle School, and Turners Falls High School.

Action Items

[To be filled out based on what Energy & Solar Planning Committee and other municipal boards want to take on in the next 3-5 years.]

Action	Lead Entity (or Entities)	Supporting Entities	Start Year/ Annually?
Forward plans for solar installation on the DPW Building	Montague Energy Committee	Finance Committee, Select Board	
Conduct on-site solar evaluations	Montague Energy Committee/Town Assistant Planner	Solar Installer	
Explore microgrid opportunities	Town Assistant Administrator	Montague Energy Committee MassCEC	
Set up an MEI account for Montague	Town Assistant Administrator	FRCOG, Green Communities Program, municipal staff	
Review energy usage data for regional middle and high schools and set up MEI account	Montague Energy Committee, Gill Energy Committee	School staff, FRCOG, Green Communities Program, school committee	
Review energy usage data for Franklin County Technical School and set up MEI account	FRCOG, school staff	Franklin County Energy Committees, Green Communities Program, school committee	
Continue exploration of microgrid opportunity	Town Assistant Administrator	MassCEC Montague Energy Committee	

Explore solar funding options for municipal projects	Montague Energy Committee Montague Energy Committee	Finance Committee, FRCOG	
Carry out financial analyses	UMass Clean Energy Extension	Energy Committee, Finance Committee	
Create a timeline for future municipal solar development	Montague Energy Committee	Finance Committee, Town Assistant Administrator, Select Board	
Explore opportunities for electric bus use & charging needs at Elementary Schools	Montague Energy Committee, School Committee	school staff, EPA, MassCEC, bus companies	
Explore opportunities for electric bus use & charging needs at regional Middle and High Schools	Montague Energy Committee, Gill Energy Committee	School Committee, Superintendent's Office staff MassCEC, bus companies	

3. RESIDENTIAL SOLAR

This section addresses solar on residential properties, including solar on house rooftops or in residential yards.

3.1 Current Status

Existing Infrastructure & Regulatory Status

Currently, Montague has about 290 small-scale solar systems representing a total of 2,034 kW of solar capacity. Most are residential systems, which have an average size of 7.26 kW in Montague. Roughly 8% of households have a residential solar system.

In Montague, residential systems fall under the category of building-mounted or accessory ground-mounted solar installations in the town's bylaw. Roof-mounted systems can be any size. Ground-mounted systems always require a special permit in Neighborhood Business, Central Business, and Recreation-Education. In the Residential 1 (RS-1) zoning district they require a special permit if the panel surface area exceeds 150 sf. In all other districts, a special permit is required if exceeding 500 sf. Because 150 sf of panels is roughly equivalent to 2.25 kW and 500 sf of panels is roughly equivalent to 7.5 kW, it is likely that all residential systems in the RS-1 district would require a Special Permit, and many in other districts would as well.

Community Perspectives

In the *Community Solar Survey*, Montague residents indicated strong support for residential solar development, with a large majority indicating that they felt "positive" or "very positive" about solar panels on residential roofs (88%) and in residential yards (78%). Only 6-8% felt negative about these types of systems.

Major reasons residents cited for not already having a system installed were upfront cost (45%), not owning the property (23%), the property being too shaded (21%), or not knowing enough about their options (18%). Other reasons cited included taking away from the house appearance/value, having a slate roof, or lacking a south-facing roof.

Of residents who did not currently have a solar array installed at their home, a large percentage were open to the possibility. A majority (53%) of respondents said they were interested in having solar panels installed at their home, 24% were not sure, and only 23% were not interested.

3.2 Future Potential

Solar Potential on Residential Rooftops & Yards

Potential residential solar capacity in Montague can be estimated through several different methods. If solar were installed on all small building roofs in town, the total technical potential would be 24 MW. However, installing solar on many roofs may not be technically or economically feasible, due to shading, roof structures, and economies of scale (i.e., installing scattered, small systems on very small roofs may not make financial sense). Based on estimates of shading on residential properties, it may be more reasonable to assume about 68% of residential properties in Montague have roofs or unshaded yard space available for solar (see *Solar Infrastructure and Resource Assessment* for more

details). If 68% of homes were to install a solar PV system of the average size in Montague (7.26 kW), it could provide about 18.5 MW of solar electricity generation capacity. This would be equivalent to about 12% of the electricity generation capacity anticipated to be needed in the future to support 100% of the community's electricity needs with solar power.

Residential solar PV systems are typically sized to generate enough electricity to cover current household electricity needs. A 5.5 kW residential solar PV system can generate what works out to an average of 600 kWh of electricity per month (the average household monthly electricity use in Massachusetts), with higher solar generation occurring in summer months and lower generation during the winter. Average monthly electricity use in Montague is 623 kWh, which is similar to the state average. The average size of a household solar PV system in Montague is 7.26 kW (rough average generation of 787 kWh per month), which suggests current solar systems in town are located on houses with higher-than-average electricity use or are designed to meet more than current electricity needs.

As personal vehicles and home heating systems are converted to electricity-based systems, we predict average household electricity use in Montague could increase by roughly 2.5x, necessitating a system of roughly 14.4 kW to offset future household electricity demand. Ultimately, if 68% of households were to install a 14.4 kW system to meet future electricity needs, residential systems could contribute 36.8 MW of solar. This is equivalent to 24% of the estimated 150 MW of solar capacity needed to offset Montagues anticipated future electricity demand.

Montague has many multi-family housing units, which would be particularly good locations for solar, since they tend to have larger roofs. As a historic farming community, there are also some residential properties with large barns. These locations are detailed in Appendix B of the *Solar Resource & Infrastructure Report*, and would be a good target for outreach efforts.

Financial Considerations

Financial costs and benefits of a residential solar are dependent on a number of factors, including the system size, system cost, electricity rates, solar incentives, federal and state tax credits, loan amount, and loan terms (interest rate, term). All of these items are site-dependent, and subject to change over time. Despite high interest rates and minimal solar incentives, our estimates suggest that residential solar systems are nevertheless currently a financially feasible option for Montague residents, because the cost of a monthly electricity bill is at this time higher than the cost of a solar loan payment, so a resident with a new solar system installed could pay less per month for electricity than one without, and after the loan is repaid, the solar system will continue to generate free electricity.

For example, UMass Five College Credit Union currently offers solar loans at a rate of 7.24% for 10 years or 7.49% for 15 years. Currently, there is a federal tax credit rebate of 30% of the cost of an installed solar system, in addition to a $1,000 tax credit available for Massachusetts state taxes. Solar incentives through the state SMART program have dropped to $0 for residential systems (<25 kW) in Montague. However, as an alternative to the SMART program, residents can earn Renewable Energy Credits for each MWh of solar

energy that is generated; RECs currently can be sold for about $34 per REC, although that number is expected to decrease over time, and our estimates use an average value of $22 per REC. With federal tax credits, state tax credits, and solar incentive payments, the monthly payment on a 15-year loan on the remaining balance for an 7.26 kW system priced at $3.59/kW (the Franklin County average according to MassCEC) is below the monthly cost of electricity generated by a system of that size that would appear on an Eversource electricity bill. For a 10-year loan, there is significant cost to the customer over the first 10 years ($180-$450 per year), but the net value is positive due to avoided electricity costs ($35,000 over 25 years, not adjusted for the opportunity cost of not investing the money elsewhere). The resident would likely need to replace the inverter for the system after about 10-12 years, but would still make money over the course of the PV system lifespan.

The financial balance could be more challenging for low-income residents. However, there are some potentially feasible options available. The nonprofit Capitol Good Fund last year began offering "DoubleGreen" solar loans at a fixed rate of 3.1%-4.2% for 25-year terms for low-income ratepayers in Rhode Island, which if offered in Massachusetts could make solar PV systems economical for low-income residents here. Low-income residents are currently eligible for an approximately $0.009 per kWh state solar incentive, or the REC payment of $34/MWh described above. Affording a solar loan might still be challenging for some low income (R-2) customers, who are eligible for reduced electricity rates to begin with, and therefore might have difficulty obtaining a monthly loan payment that is lower than their reduced electricity bill. UMass CEE can assist in estimating the specific financial costs and benefits for Montague residents.

3.3 Next Steps & Action Items

Potential Next Steps

Since there is strong interest and support for residential solar, there is potential for a large increase in solar capacity on residential roofs and in residential yards. The major barriers to overcome appear to be 1) lack of knowledge of options, 2) financial concerns, 3) logistical challenges with locating solar PV systems on some shaded residential properties, and 4) lack of participation in solar programs by landlords.

Public Information Sessions

In order to overcome general hesitancy, address concerns, and increase resident knowledge, Montague residents could benefit from annual or semi-annual public information sessions about residential solar, highlighting state and federal incentives and solar loan options, addressing safety concerns, and elucidating the range of options available. Some recommendations regarding these sessions include:

Speakers and content. It would be helpful to include participation by town residents who have had solar installed, and who could speak to the benefits and any challenges associated with installing a residential solar array. This session could include specific financial information (see below), opportunities for neighbors to coordinate on solar installations, and, importantly, information for landlords and renters.

Financial analysis of residential systems. CEE is happy to work with Montague to provide a simple calculator to help residents at a public forum estimate the costs and benefits of a solar system that meets their needs and specifications.

Specific solar loan programs available through financial institutions. CEE plans to compile a list of institutions involved in solar financing around the state, and specific solar loan programs, which could be addressed included the public forum. The state's Mass Solar Loan program is no longer active. If revived, it would be helpful to include information about this program as well.

Handouts and Factsheets

In addition to information sessions, factsheets/handouts with content similar to that provided at Public Information Sessions could be distributed at annual Town Meeting or other local events.

Opportunities to Share Solar

Forested residential properties, as are common in Montague, may not be appropriate for solar. Residents may in some cases choose to cut some trees to provide an opening for solar, but this is not always possible or preferred. In addition, Montague has many renters whose landlords may not be interested in installing solar on their properties. Creative approaches are necessary to provide residents of shaded properties and renters the benefits of solar. Solutions to give these residents access to solar include:

Neighbors helping neighbors. Residents with properties that could host solar have the opportunity to install a larger system that meets more than their current needs. There are not clear financial models available at present to have neighbors jointly own a small array and share in tax credit benefits. However, there are straightforward pathways for net metering agreements between community residents to share in the

benefits of solar generation. In this situation, a resident with a large roof might install and own a system larger than that necessary to meet their own needs, then net-meter electricity credits over to a different community member's account through a form known as a Schedule Z. It is possible (and common) to establish a legal contract which could guarantee the price per net metering credit - providing the project host/owner a known income each year - and such an agreement could include a commitment to pay a portion of upfront installation costs.

Community solar array. If about one-third of residential properties in Montague cannot host solar, there is likely to be appetite for community solar for people who own shaded properties. In addition, there may be renters who plan to stay in the area long-term, but don't have a property on which they can install solar. It is worth considering whether there are properties where a community-owned project on public or private land could be owned by a group of local residents.

Residential Solar Campaign

The town Energy Committee or a committed group of residents could conduct a Solarize Mass-style campaign to encourage multiple households to install residential solar PV systems at the same time. The Solarize Mass program is no longer active, but the campaign tools developed as part of the program are still available. The benefits of such a campaign include neighbor support in the purchasing of a solar array and the opportunity to work through challenges together, as well as the feeling of participation in a collective, community effort. In addition, residential solar campaigns can lead to lower installation costs, due to economies of scale associated with the solar installer working on multiple projects in one location.

Specific Next Steps

Based on the above, specific potential next steps for residential solar development include:

- Organize and hold a community solar forum once annually to discuss options for residential solar development.
- Design and distribute flyers/handouts to explain residential solar development options, highlighting their financial feasibility, and including a description of how to arrange a net metering agreement with a neighbor to share solar electricity generation.
- Research sites in each neighborhood around town which could be potential sites for community-shared solar facilities, possibly incorporating battery storage, so as to allow for an emergency shelter site in each neighborhood during an outage.
- Conduct a residential solar campaign once every # years, with a goal of recruiting # households per campaign.
- Reach out to owners of multi-unit housing to explore possibilities to grant renters the benefits of solar electricity.

Action Items

Action	Lead Entity (or Entities)	Supporting Entities	Start Year/Annually?
Organize and hold a community solar forum	Montague Energy Committee (MEC)	CEE, Solar Installers, Financial Institutions	
Design and distribute a residential solar handout	Solar Planning Committee (SPC) MEC		
Research sites around town which could support community-shared solar facilities			
Conduct a residential solar campaign	MEC (has conducted campaign previously)		
Reach out to owners of multi-family housing	SPC MEC		

4. SOLAR FOR BUSINESSES AND INSTITUTIONS

This section addresses solar on commercial and institutional buildings and parking lots.

4.1 Current Status

Existing Infrastructure

The majority of smaller solar facilities in Montague are residential, not commercial or institutional. There are five medium-scale (greater than 25 kW to 500 kW) solar facilities in Montague, totaling 498 kW.

There are a number of large buildings and large paved areas on commercial and institutional properties which might be suitable for solar (see *Future Potential* below).

Current Regulatory Status

In Montague, rooftop solar is considered a building-mounted system, it can be any size and is allowed by right in all zoning districts. The wording of the town bylaw is somewhat confusing. The building-mounted definition states:

A solar energy installation that is permanently affixed to a building, as defined by the building code. ***This definition is inclusive of canopy structures.*** [emphasis added]

It is not clear if this includes solar canopies over parking lots, or is intended to describe canopies extending out from the building. If solar canopies are not included in this category, they would fall under the "accessory ground-mounted" category (if serving primarily on-site load) and would require a Special Permit in all districts, based on their anticipated size. If not serving primarily on-site load, they could be subject to general restrictions on solar energy facilities, and only allowed by Special Permit in the Industrial and Historical-Industrial districts with a Special Permit.

Community Perspectives

Residents expressed strong support for development on developed spaces generally. A majority supported 100% of large roofs and parking lots being developed. Residents were also asked if a business using solar energy would affect their attitude toward the organization: 65% of residents answered that it would make them feel more positive towards the organization, and 29% said it would make them more likely to purchase goods or services from the organization. Less than 1% of people said it would make them feel negatively towards the organization. Overall, people felt very positive towards solar panels on businesses and institutions.

4.2 Future Potential

We identified a number of businesses and institutions which could be approached regarding their interest in installing solar arrays on commercial rooftops or as solar canopies over existing parking lots.

Commercial & Institutional Rooftops

Rooftops can provide roughly 1.5 kW of solar per 100 sf of suitable roof space. On medium roofs (5,000-25,000 sf), about 49% of the roof area is suitable for solar; on larger roofs (25,000+ sf) about 66% of the roof area is suitable for solar.

There are 71 commercial and institutional rooftops in Montague with areas over 5,000 sf, totaling 1.5 million sf in area and 13.6 MW of technical solar potential. The largest rooftops in Montague (over 10,000 sf) are shown in **Table 4**. All commercial and institutional roofs over 5,000 sf are listed in Appendix A.

Structure/Ownership Status	Street Address	Total Roof Area (sf)	Estimated Technical Solar Potential (kW)
Judd Wire	124 Turnpike Rd	253,121	2,483
Heat Fab	130 Industrial Blvd	141,198	1,385
New England Extrusion, Inc.	Industrial Blvd	101,873	999
Hillside Plastics	262 Millers Falls Rd	71,516	701
Mayhew Steel Products	199 Industrial Blvd	70,105	688
Walgreens complex	250 Avenue A	65,877	646
LightLife Foods	Rear LightLife Way	59,366	582
Montague Machine Co.	15 Rastallis St	55,830	548
Atlantic Golf & Turf	27 Industrial Blvd	52,367	514
Paperlogic	36 Canal Rd	49,771	488
253 Farmacy Recreational Weed Dispensary	253 Millers Falls Rd	29,947	294
JaDuke Center - Performing Arts	110 Industrial Blvd	21,087	154
FirstLight Hydro Facility	15 Cabot St	19,725	144
Turbosteam Manufacturing	161 Industrial Blvd	17,908	130
Business Complex	320 Avenue A	16,883	123
Pioneer Aviation Building (Airport)	40 Industrial Blvd	14,696	107
Rubin's Auto Service	194 Millers Falls Rd	14,612	106
US Geological Survey (Government Building)	1 Migratory Wy	14,251	104
Closed business	310 Federal St	13,692	100
US Geological Survey (Government Building)	1 Migratory Wy	13,522	98
Office	282 Avenue A	12,397	90
Business Complex	123 Avenue A	12,224	89
Montague Housing Authority Maintenance	41 Sunrise Terrace	12,068	88
Office	241 Millers Fall Rd.	11,696	85
Baystate Health Hospital	8 Burnham St	11,147	81
Office	42A Canal Rd.	10,421	76
Millers Falls Rod & Gun Club	210 Turners Falls Rd.	10,351	75

Table 4 The 28 largest roofs owned by businesses or private institutions with large areas potentially suitable for solar. All commercial and institutional roofs over 5,000 sf are included in Appendix A.

Almost all of these locations are in or near downtown Turners Falls and in close proximity to three-phase lines. The only exceptions are the buildings on Federal Street and Turners Falls Road.

Commercial & Institutional Parking Lots

Potential sites for solar canopies on parking lots owned by businesses or institutions are summarized in **Table 5**. Parking lots can have a packing density of approximately 263 kW per acre[1], but because the paved areas noted here in some cases include driveways, estimates of technical potential based purely on acreage are likely to be overestimated. All

of these locations would require on-site evaluations to understand use patterns, available space, and actual solar potential.

Location/Ownership Status	Approximate Area	Estimated Solar Technical Potential (kW)
Montague Machine Co.	2.03	534
Food City, Salvation Army, Walgreens, Family Dollar, Aubuchon Hardware	1.80	473
Unity Park Community Garden	1.73	455
Kelter Ronald A Nursing Home	1.63	429
Montague Elks Lodge	1.60	421
Shady Glen	0.85	158
Our Lady of Peace Church	0.63	166
Montague Housing Authority Maintenance	0.60	158
Basketball Court	0.53	139
Highland School Apartments	0.53	139

Table 5 Privately owned properties with large areas of parking lots suitable for solar.

Solar arrays over 50 kW in size often must connect to three-phase electricity distribution lines to interconnect to the electricity grid safely. All of the parking lots in **Table 5** are located near three-phase lines.

Financial Considerations

Financial costs and benefits of commercial and institutional solar are dependent on many factors, including system size, system cost, electricity rates, solar incentives, federal and state tax credits, loan amount, and loan terms (interest rate, term). All of these items are site-dependent, and subject to change over time. Currently, there is a federal tax credit of 30% of the cost of an installed solar system, in addition to a $1,000 tax credit available for Massachusetts state taxes. Through the passage of the federal Inflation Reduction Act, non-profit organizations who do not owe taxes are now eligible for a direct payment equal to 30% of the installed cost of a new solar system. Depending on the size, location, and type of system, new solar arrays may also be eligible for solar incentives through the state SMART program on a fixed $/kWh basis; alternatively, businesses and institutions can earn Renewable Energy Credits for each MWh of solar energy that is generated.

Some financial institutions offer business loans which can be applied to solar projects or may offer specific solar loans designed to cover the costs of new solar arrays. For example, UMass Five College Credit Union currently offers solar loans for up to a 10-year term. More information about financing and other aspects of solar for businesses and institutions can be found at: https://www.masscec.com/resources/commercial-solar-information-hub.

Through the Commercial Property Assessed Clean Energy (C-PACE) financing program, business and industry owners can agree to a betterment assessment and lien on their property, sufficient to repay the financing extended by a private capital provider. Since

Montague has opted into the C-PACE program, it is option available to businesses and industries in the town. MassDevelopment facilitates C-PACE financing for energy improvements, including solar.

4.3 Next Steps & Action Items

Potential next steps for solar development on at businesses and institutions include:

- Conduct outreach to the businesses and institutions in town with the largest roofs and parking lots (Tables 4 and 5) to assess their interest in solar or solar plus energy storage on roofs or over parking lots. Stress solar survey results indicating local support for businesses that use solar energy.
- Turners Falls has many businesses with significant space on rooftops and parking lots. Conduct a door-to-door campaign to provide on-site solar evaluations and educational resources to businesses in this village. Consider whether a similar campaign might also be feasible in Millers Falls.
- If using town libraries as local emergency shelter sites (outside of Turners Falls) is not feasible, reach out to religious institutions, social halls, or nonprofit organizations in other villages to assess their interest in serving as local emergency shelters and the feasibility of solar plus battery storage at these locations.
- Assist interested businesses with estimation of costs and rebates.
- As noted above, reach out to owners of multi-family housing regarding solar on long-term rental properties.

Action Items

[To be filled out based on what Energy & Solar Planning Committee and other municipal boards want to take on in the next 3-5 years.]

Action	Lead Entity (or Entities)	Supporting Entities	Start Year/ Annually?

5. ON-FARM SOLAR

This section addresses solar on farms, including solar arrays on farm buildings and greenhouses, solar canopies designed to shelter parked farm vehicles, and ground-mounted solar development on land owned by farm businesses or actively farmed.

5.1 Current Status

Existing Infrastructure

Montague has many active farms and significant acreage in agricultural production. Based on Mass GIS Land Cover data, the town has roughly 631 acres in cultivation and 553 acres in pasture or hay production. 965 acres of agricultural land are protected in perpetuity through an Agricultural Preservation Restriction. In addition, at least 57 properties totaling 722 acres participate in the Chapter 61A program for the purposes of agricultural production (not including productive woodlots).

Farms and agricultural businesses in Montague include:

- Big Foot Food Forest: 16 Hatchery Road
- Boulder Top Farm: 8 Richardson Road
- Brook's Bend Farm: 119 Old Sunderland Road
- Falls Farm CSA: 202 Old Sunderland Rd
- Great Falls Aquaculture: 1 Australia Way
- Little Song Farm: 119 Old Sunderland Road
- Our Family Legacy Farm: 442 Turners Falls Road
- Ox and Robin: 131 Chestnut Hill Loop
- Red Fire Farm: 184 Meadow Road
- Ripley Farm: 11 W Chestnut Hill Road
- Sugarbush Farm: 47 Davis Road
- They Keep Bees: 258 Greenfield Road
- Waidlich Farm: East Mineral Road
- Xenophon Farm: 80 Sunderland Road

Many of these farms are clustered along the Connecticut River.

There are many roofs on barns, farm buildings, and greenhouses which could be suitable for solar (see *Future Potential*).

There is some existing solar on Montague farms; Red Fire Farm (184 Meadow Rd) has one solar-powered greenhouse, featuring 9,461 sf of solar panels on its roof, with a solar energy capacity of 66 kW. Xenophon Farm also installed some solar through a SolarizeMass campaign.

Current Regulatory Status

Solar arrays on the roofs of barns and other agricultural structures (likely including greenhouses) would be considered building-mounted systems; as stated previously, these are allowed by right in all zoning districts.

Ground-mounted systems serving on-site load would fall under the "accessory ground-mounted" category and would require a Special Permit in all districts, based on their

anticipated size. Standalone solar energy facilities are only allowed in the Industrial and Historical-Industrial districts under the current town bylaw, and hence likely could not be built on agricultural land.

Community Perspectives

Montague residents were generally not supportive of widespread ground-mounted solar development on farmland. In fact, a slim majority of respondents indicated that they wanted no agricultural land developed for solar; the average percentage of all farmland in town that respondents were comfortable seeing developed was 15%.

However, residents did respond more favorably to certain types of solar facilities installed on farms. These included:

- Solar panels raised above agriculture land to allow farming to continue beneath (50% support/26% neutral)
- The edges of active agricultural land converted to solar (47% support/28% neutral)

Residents expressed strong opposition to traditional solar development on land currently in vegetable production (87% oppose) or hayfields/pasture (71% oppose). There was somewhat less opposition to development of fallow farmland not currently in production (51% oppose/20% neutral/29% support).

5.2 Future Potential

Rooftops and Greenhouses

There are approximately 131,200 sf of roofs over 5,000 sf on barns and other agricultural buildings which could be suitable for solar. In addition, there are approximately 26,500 sf of existing greenhouses in Montague. These total at least 1,130 kW (1.1 MW) of solar potential.

Locations with the greatest potential for roof-mounted solar on farm rooftops are summarized in **Table 6**. All of these roofs would require on-site evaluations to review the underlying roof structure, identify any shading concerns from adjacent vegetation, identify roof-mounted equipment that could interfere with the placement of solar panels, and determine actual solar potential.

Note that we identified no large parking lots associated with agricultural businesses.

Structure/Ownership Status	Street Address	Total Roof Area (sf)	Estimated Technical Solar Potential (kW)
Great Falls Aquaculture	1 Australia Wy	69,300	680
Greenhouse - Red Fire Farm	184 Meadow Rd	9,461	Already developed
Greenhouse - Red Fire Farm	184 Meadow Rd	9,105	TBD
Barn - Agricultural	South Ferry Rd	8,846	64
Greenhouse - Red Fire Farm	184 Meadow Rd	7,986	TBD
Barn - Agricultural	Old Greenfield Rd	7,324	53
Barn - Agricultural	Meadow Rd	5,982	44
Barn - Agricultural	Meadow Rd	5,973	43
Barn - Agricultural	8 Wills Ferry Rd	5,838	43
Barn - Agricultural	Meadow Rd	5,791	42
Barn - Agricultural	Meadow Rd	5,704	42
Barn - Agricultural	157 East Mineral Rd	5,532	40
Closed business	310 Federal St	5,477	40
Barn - Red Fire Farm	172 Meadow Rd	5,415	39

Table 6. Agricultural buildings with large roofs suitable for solar.

The largest three agricultural rooftops in Montague could potentially host a solar array over 50 kW in size. The largest two, on Australia Way and South Ferry Road, are both located near three-phase lines. The site at Old Greenfield Road is not near three-phase lines, but given that it is only 53 kW, it would not be unduly limited in capacity by the presence of single-phase lines. Solar arrays under 50 kW in size can typically safely connect to single-phase or three-phase electricity distribution lines.

In addition to rooftops, Montague has a number of large greenhouses which could be converted to solar greenhouses. Farmers could all consider opportunities to install new solar greenhouses or solar canopies used to shelter vehicles.

Ground-Mounted Solar: Agrivoltaic & Conventional Ground-Mounted Systems

Montague residents were generally not supportive of ground-mounted solar development on farmland, but did respond more favorably to agrivoltaic facilities and installations on the edges of agricultural fields.

Agrivoltaic Projects

All farms, but particularly those which graze livestock (including dairy cows) or carry out hay production, might be interested in pursuing an agrivoltaic project.

"Agrivoltaic" refers to agricultural production and electricity production from solar PV panels occurring together on the same piece of land. These facilities may also be referred to as agrisolar, "dual-use," or co-location of solar and agriculture. Rows of solar panels in these systems are generally placed further apart and raised higher above the ground to

allow agricultural activities to continue to be conducted beneath them, ensure crops receive appropriate sunlight, and make it possible for farm vehicles to easily access all areas in agricultural production.

Agrivoltaic systems are still relatively new, and their economic potential in the temperate Northeast is still being explored. There is currently a lack of robust research and information on (1) the agricultural productivity of these systems, (2) the economic impacts of dual-use systems on farms and farmers, and (3) the effect of these systems on the broader agricultural economy. In general, agronomists are relatively comfortable with the idea that pasture and hay fields can be anticipated to produce reasonable yield of hay or forage, but less is known about the appropriateness of these systems for fruit and vegetable production. UMass Extension is currently working with project partners to better study and understand the agricultural yield and economic aspects of these systems (see https://ag.umass.edu/clean-energy/research-initiatives/dual-use-solar-agriculture/researching-agricultural-economic-impacts-of-dual-use-solar).

Conventional Projects

Residents expressed strong opposition to traditional solar development on land currently in agricultural production. However, residents were open to smaller projects installed in the margins of farm fields, and had mixed feelings towards solar arrays installed on fallow farmland.

Locations for Ground-Mounted Systems

Small solar projects (under 50 kW) could be interconnected to the grid anywhere in town where distribution lines are present. Currently, larger projects (>50 kW) are likely only feasible in areas serviced by three-phase distribution lines, or areas within roughly ½ mile of those lines.

As apparent in **Figure 1** below, Montague has an extensive network of three-phase lines, but many of these are concentrated in the northern part of town, away from large areas of open land. Large sections of the town are permanently protected from development, and there are only a few locations where cultivated land, hayfield, or pasture is located near three-phase lines. Given the limited distribution of unprotected, agricultural land in Montague, development of large-scale solar projects on or adjacent to agricultural land may not be a widely applicable option in the community.

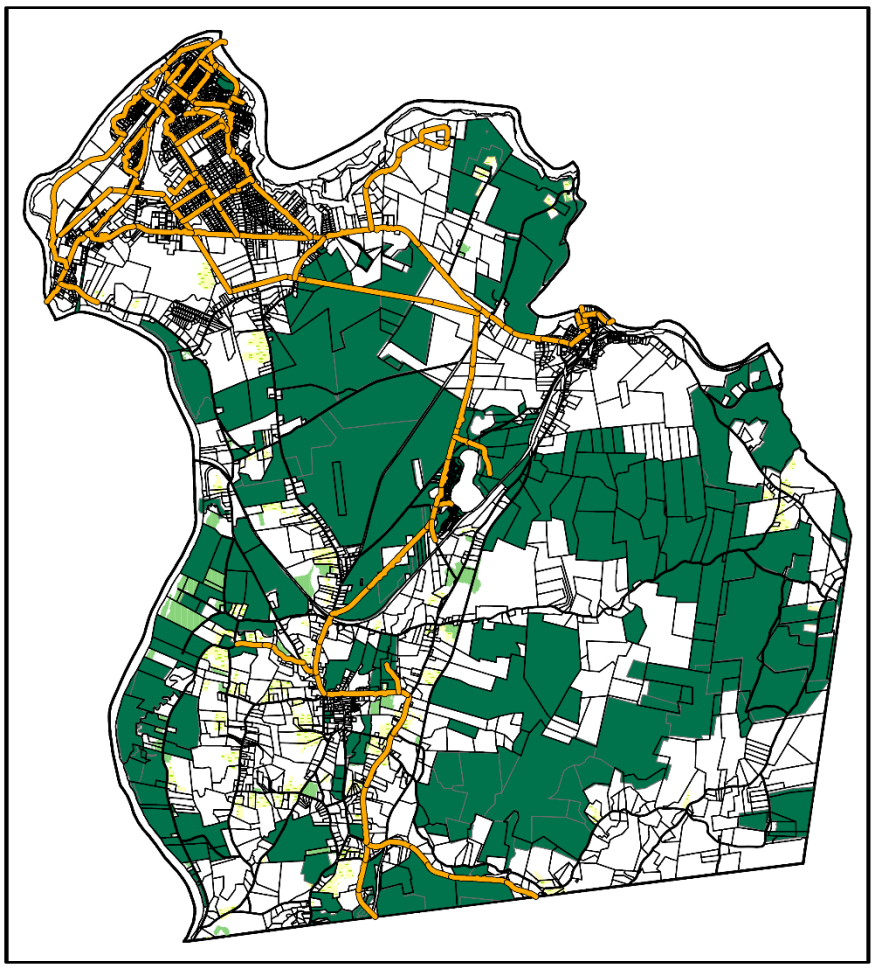

Figure 1. Map showing Montague, with three-phase lines in orange, hayfield and pasture in light yellow, cultivated land in light green, and permanently protected land in dark green.

Financial Considerations

Financial costs and benefits of rooftop, greenhouse, or parking canopy solar projects on farms are dependent on many factors, including system size, system cost, electricity rates, solar incentives, federal and state tax credits, loan amount, and loan terms (interest rate, term). All of these items are site-dependent, and subject to change over time. Agricultural projects are eligible for the same federal and state tax credits as other types of systems. These types of projects are also likely to be eligible for SMART solar incentives (on a fixed #/kWh basis) or Renewable Energy Credits (for each MWh of solar energy generated, RECs are sold at auction). Grants to develop solar PV projects that support on-farm energy needs may be available through the state's Agricultural Energy Grant Program.

Agrivoltaic projects may be eligible for an Agricultural adder through the SMART program. In order to qualify for incentives, these projects must be 25 kW in size or larger. To be economical, these projects are often much larger – the average size of standalone dual-use agricultural projects currently in the state program is roughly 3.2 MW DC (~15 acres), although one Agricultural project of 25 kW (~1 acre) has been constructed.

Conventional, ground-mounted solar projects may also be eligible for SMART solar incentives or RECs. Current SMART program regulations place some restrictions on solar development on agricultural land – some large, conventional developments on recently active agricultural land may not be eligible for incentives.

5.3 Next Steps & Action Items

- Conduct outreach to Red Fire Farm to assess their interest in roof-mounted solar and additional solar greenhouses to support farm needs or sell electricity to neighbors.
- Conduct outreach to Great Falls Aquaculture and owners of other properties with large barns roofs (Table 6) to assess their interest in roof-mounted solar.
- Consider outreach to other farm owners/operators noted in *Existing Infrastructure* to assess their interest in small-scale roof, canopy, or ground-mounted solar.
- Assist interested farms with evaluating and applying to grant opportunities for agricultural energy projects, as well as evaluating costs and benefits of other financing structures.

Action Items

[To be filled out based on what Energy Committee and other municipal boards want to take on in the next 3-5 years.]

Action	**Lead Entity (or Entities)**	**Supporting Entities**	**Start Year/Annually?**
Outreach to farms, businesses in table 6	Agricultural Commission?	SPC MEC	
Assist interested farms with evaluating , applying for grants for agricultural energy projects, and evaluating costs and benefits of other financing structures.			

6. LARGE, GROUND-MOUNTED SOLAR ON PRIVATE LAND

This section addresses large, ground-mounted solar development on private land, including solar projects sited on previously disturbed sites (e.g. gravel pits, quarries, right-of-ways, private landfills, brownfields) and those sited on undeveloped land (e.g. forest, meadow, shrubland) not addressed under On-Farm Solar.

6.1 Current Status

Existing Infrastructure

Current Land Use
According to Mass Audubon's *Losing Ground* report, Montague ranks 40th in the state in terms of the total amount of protected land, with 7,915 acres (39%) of the town under permanent protection. One-tenth of the land area of Montague is currently developed for housing, businesses, or other purposes.

Despite having a large percentage of conserved land, the town also has a significant acreage of privately owned forest and other natural habitat that is not conserved, which means the potential for large, ground-mounted solar development on undeveloped land remains.

Solar Infrastructure
Montague has four large-scale facilities (greater than 500 kW) totaling about 12 MW. Two of the large-scale ground-mounted solar arrays were addressed in the municipal section and are located on an old town landfill. The other two large projects are a 1,422 kW DC project located at 131 Turnpike Road, which came online in 2019 and a 1,188 kW DC project located at 248 Millers Falls Road, which came online in 2020.

Grid Infrastructure
Montague has an extensive network of three-phase lines, primarily concentrated, as noted previously, in the northern sections of town.

The following areas of town have three-phase power:

- Northern portions of Montague, especially downtown Turners' Falls and Montague City, which are both served by multiple three-phase power lines.
- Three-phase lines extend northeast from Turners Falls to the Turners Falls Airport on Millers Falls Road and Industrial Blvd.
- One three-phase line enters Millers Falls via Millers Falls Road, serving Crescent Street, South Prospect Street, and Newton Street.
- One three-phase line extends south along Lake Pleasant Road, serving Lake Pleasant, as well as Turners Falls Road south from Swamp Road to Center Street and Route 63. Meadow Road is also served by an off-shoot of this line.
- This line continues south along Route 63 to Montague's southern border, also providing service to North Leverett Road.

The remainder of town is largely served by single-phase lines.

Current Regulatory Status

Large ground-mounted solar (exceeding 2,000 sf of panel surface area) is prohibited in all districts except for the Industrial and Historical Industrial Districts, where it is permitted by Special Permit with Site Plan Review. These districts cover areas on the margins of Turners Falls, as well as between Turners Falls and Millers Falls.

Community Perspectives

In the *Community Solar Survey*, Montague residents expressed support for solar development on some types of previously disturbed lands. Residents indicated a strong preference for large, ground-mounted solar development on former landfills and brownfields (87% support/9% neutral), former sand/gravel extraction sites (85% support/11% neutral) and electricity transmission line right of ways (78% support, 15% neutral).

For all other types of forested and open natural habitats, 70-93% of residents expressed opposition to development. These habitats included meadows, shrublands, and large and small patches of new growth or mature forest, as well as priority wildlife habitat. A majority of residents wanted to see no natural lands developed for solar; the average percentage of natural lands respondents were comfortable seeing developed was 9% of natural lands in town. (Some development of undeveloped land would be needed to meet solar goals of community self-sufficiency or help meet state goals – both options support by residents - but it would be equivalent to 4% or less of agricultural and natural lands.)

In another portion of the survey, residents did indicate support for development along major roads (64% support/17% neutral), which in Montague could include Routes 63 and 47.

6.2 Future Potential

Constraints on Large, Ground-Mounted Solar Development

Development of large, ground-mounted solar on large private properties in Montague is likely to be constrained by a number of factors. For all sites, these factors include 1) opportunities for interconnection to the electricity grid, 2) the locations of property owners willing to lease or sell their land for solar development, 3) potential project scale, and 4) eligibility for state solar incentives. For undeveloped lands, 5) existing conservation restrictions and 6) wetlands protections are also an important factor. While factor 2 cannot be determined without direct consultations with specific landowners, factors 1, 3, 4, 5, and 6 can be assessed in some detail.

Interconnection Opportunities. Large solar facilities require three-phase power lines in order to interconnect to the grid, so in the near-term, large facilities are most likely to be proposed in areas of town served by or adjacent to three-phase power. Areas currently served by three-phase power are described in the *Grid Infrastructure* section above.

Existing Conservation Restrictions. As noted above, roughly 39% of Montague's land area is under permanent protection and ineligible for solar development. Additionally, at least 2,121 acres (10.5%) are in temporary protection due to participation in the Chapter 61, 61A, or 61B programs. Participation in these programs does not exclude the possibility of solar development but could make development economically

unfavorable if back-taxes are required to remove the land from the program, or may allow the town right-of-first-refusal on any property lease or sale.

Wetlands Restrictions. The presence of wetlands on a property may also limit the extent of development, since solar development is prohibited on wetlands and buffers around a protected wetland are often required. Solar development is regulated within 100 ft of most wetlands and water bodies, and within 200 ft of most perennial streams and rivers, according to state law.

Eligibility for State Solar Incentives. In addition to the need for interconnection to three-phase lines, in order for solar development to be economically feasible, large-scale projects may need or desire to qualify for state solar incentives. At present, with limited exceptions, the current state solar program (SMART) does not provide incentives for solar facilities sited on land mapped as BioMap2 habitat or for parcels on which more than 50% of the habitat is mapped as BioMap2. BioMap2 identifies key habitat for protecting species of conservation concern, biodiversity, and important natural communities.

Project Scale. An important aspect of economic viability for solar projects is project scale. Because interconnection costs are high and often fixed, as well as due to economies of scale, the larger the solar project, the more financially feasible it tends to be. With this in mind, the larger the area available for development, the more likely it is to be attractive to solar developers. Large parcels of land (e.g., 5-10 acres or more) are likely to be of greater interest for development, especially if few or no protected land resources are present (e.g., wetlands, water bodies, BioMap2 habitat).

The following sections describe different types of locations where large, ground-mounted solar could be developed, couched within the context of these constraints.

Disturbed Sites

There are a number of previously developed and disturbed sites in Montague, in addition to the municipal landfill sites and brownfields discussed previously.

Sand and Gravel Operations. Tax parcel data identifies two properties with sand-and-gravel operations along Federal Street, and one other mining/quarrying operation, located at 9 Woodland Drive. Little disturbance is evident at 9 Woodland Drive, although it could be associated with the larger operation on an adjacent property along Federal Street. That property currently has roughly 4-5 acres of land disturbed as part of the sand and gravel operation, out of a total of 17.5 acres. If that site becomes inactive, developing the current 4-5 acres could yield 1 MW of solar capacity. Developing the full property for solar would support roughly 3.5 MW of solar capacity. The other sand-and-gravel site is on the western side of Federal Street near the southern border of town. This site has roughly 1.6 acres of disturbed land. The full lot is roughly 15 acres. This site, if it became inactive, could support 0.3 MW of development on the disturbed area, or 3.0 MW on the full lot.

Other Disturbed Areas. We also looked at land identified as "bare land" using MassGIS land cover data in order to identify any additional disturbed sites. There are some areas of bare soil around the Hillside Plastics building on Millers Falls Road, but these appear to be used as storage areas for large shipping containers and hence are likely not suitable for

solar. On Turnpike Road there are roughly 5 acres (1 MW potential) of disturbed land near Demers Landscaping. Some of this area is being used as a storage site for materials, but some could likely be developed for solar – or the entire site could, if it became inactive for its present use.

Rights-of-Way

There are three electricity transmission right-of-ways (ROWs) that run through Montague (**Figure 2**). One cuts in a zig zag through the central part of Montague. It is 5.3 miles long and roughly 180 feet wide. The total area is 115 acres. A second transmission line runs down the south-east corner of Montague. It is 4.5 miles long and 180 feet wide. This has a total area of 100 acres. A third transmission line runs from the southern end of Montague to the substation on the north-west side of Montague. This is 8.7 miles long and roughly 150 feet wide. This has a total area of 160 acres.

It is likely that much of this area would not be suitable for solar, due to steep slopes, viewshed considerations in high-elevation portions of the ROW, and bordering trees providing too much shade on the edges of the ROW.

ROWs are located immediately under transmission lines, but solar arrays are more typically connected to distribution lines or directly to substations. In Montague, the second ROW (in the northeast corner) is far from any three-phase lines, and runs through large areas of protected land. However, the other two ROWs are criss-crossed by three-phase lines in several locations, and the third transmission ROW described runs directly to the Montague Cabot substation.

A major challenge in developing ROWs is that there is not a common practice of developing electricity transmission ROWs for solar. Utility companies typically prefer to keep these areas clear to allow for easy maintenance of transmission lines as well as underlying vegetation. However, this land area represents a potentially untapped resource for solar across Massachusetts. In the *Community Solar Survey*, residents were strongly supportive of solar development in transmission right-of-ways.

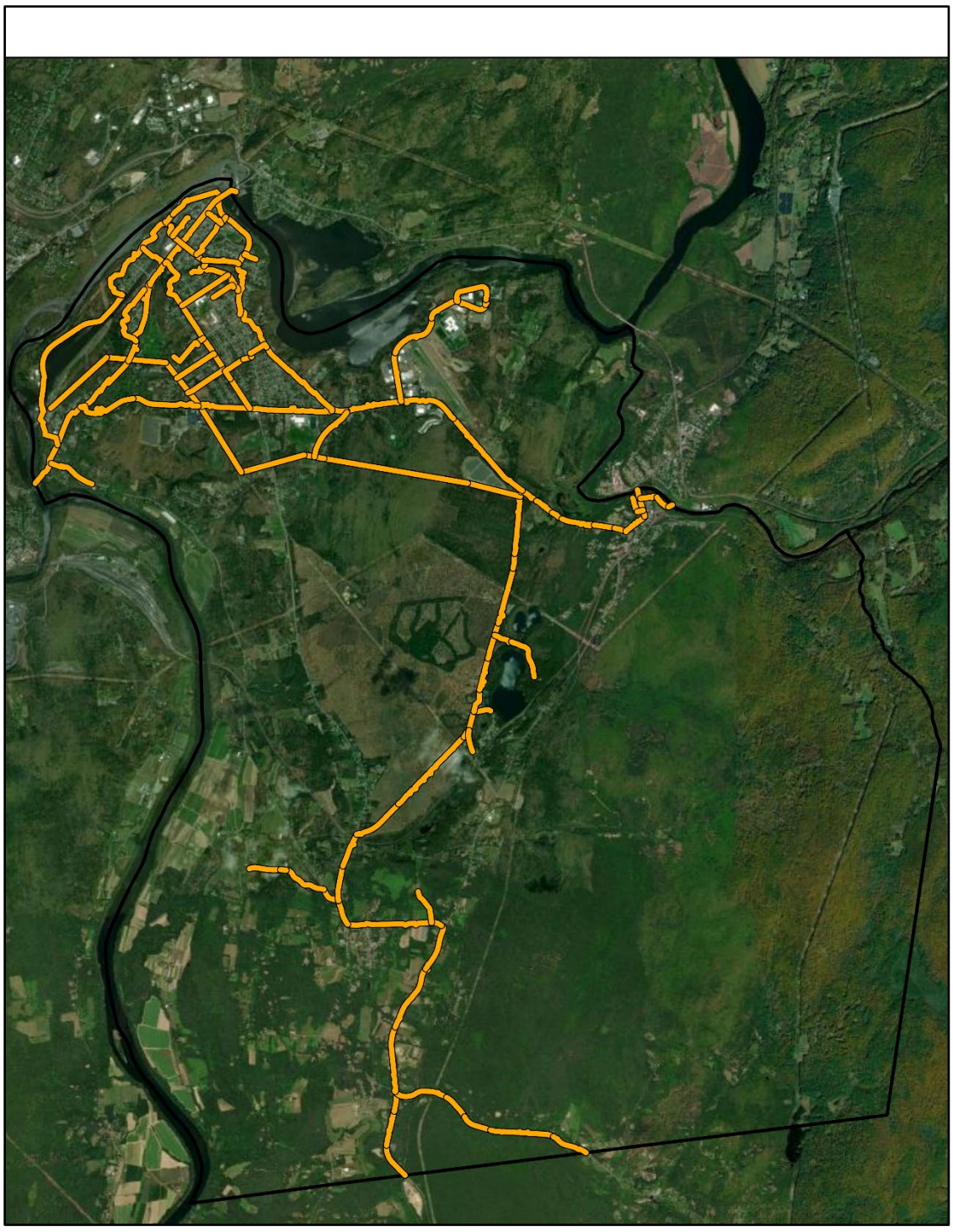

Figure 2. Map showing transmission ROWs running through Montague. Town borders are shown in black, three-phase lines are shown in orange; the ROW appears in satellite imagery as a pale, tan lines against green forest and other land uses.

Parcels Adjacent to Major Roads

Community Solar Survey results showed that residents were generally opposed to development of undeveloped land, but supported solar development in parcels along major

roads. Routes 47 and 63 run through portions of Montague, but only Route 63 has three-phase power along a portion of its length, south of Center Street to the town's southern border. As shown in **Figure 3**, much of this southern portion of Route 63 runs through areas that are permanently protected and/or mapped as important wildlife habitat. Just north of North Leverett Road, there are some properties, particularly on the east side of Route 63, that are not mapped as important habitat and not currently protected.

If three-phase power were to be extended up Route 63 towards Millers Falls, there are additional areas through the central portion of Montague and again just outside of Millers Falls along Route 63 that are not protected and not mapped as priority habitat.

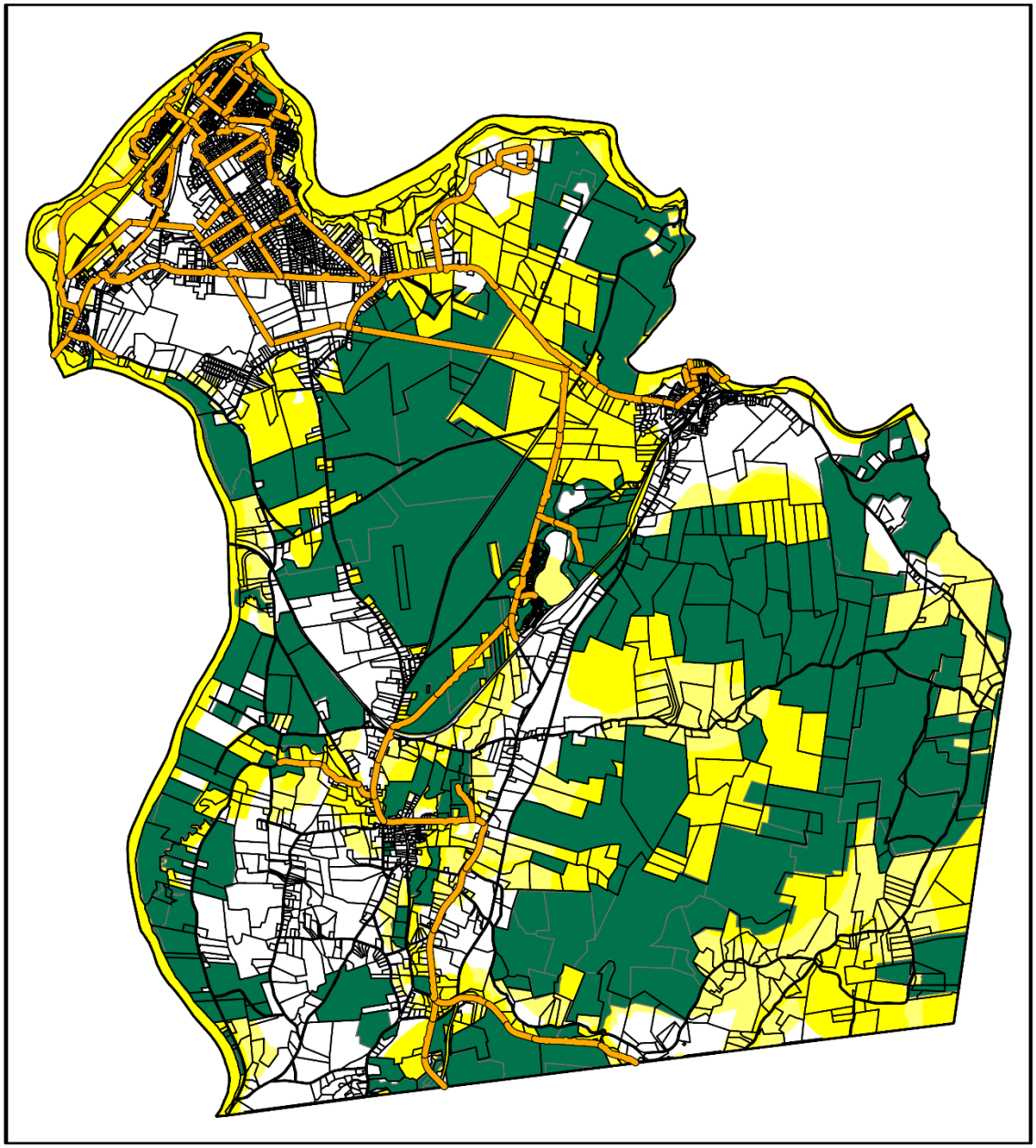

Figure 3. Map showing Montague, with three-phase lines in orange, BioMap2 core habitat and critical natural landscapes in dark and light yellow respectively, and permanently protected land in green.

Other Locations

Because Montague has so much land that is mapped as important habitat or is permanently protected, it is difficult to identify large parcels appropriate for large-scale solar development. However, it is worth noting several locations:

- Sections of Taylor Hill Road are not mapped as priority habitat for wildlife. These areas are not served by three-phase power currently, but could be of interest for solar development if the grid was built out in this area.
- Solar development south of Turnpike Road in Montague City could be expanded.
- East of Millers Falls and Lake Pleasant are some large areas not mapped as important wildlife habitat, which back up to an ROW. Three-phase power would only need to be extended about 0.25 miles to serve this area.

Financial Considerations

Financial costs and benefits of solar projects on disturbed sites are dependent on many factors, including system size, system cost, electricity rates, solar incentives, federal and state tax credits, ownership structure, and financing. All of these items are site-dependent, and may be subject to change over time. Solar projects on previously disturbed sites are eligible for the same federal and state tax credits as other types of systems. These types of projects are also likely to be eligible for SMART solar incentives (on a fixed #/kWh basis) or Renewable Energy Credits (for each MWh of solar energy generated, RECs are sold at auction).

6.3 Next Steps & Action Items

- Reach out to the owners of disturbed sites identified in this section to consider whether solar development might be a possibility.
- Reach out to Eversource (with CEE assistance) regarding community interest in development of ROWs.
- Reach out to owners of large parcels along southern Route 63 that are not mapped as priority wildlife habitat to explore their interest in large-scale solar development.
- Reach out to owners of large parcels east of Millers Falls not mapped as priority wildlife habitat to explore their interest in large-scale solar development.
- Reach out to owners of parcels south of Turnpike Road in Montague City to assess the possibility of expanding solar facilities in this vicinity.
- Reach out to Eversource regarding the potential extension of three-phase power north along Route 63 and east of Millers Falls to support additional solar development.
- Work with Franklin Land Trust or other land conservation organizations to identify at-risk parcels near three-phase lines of high conservation and recreation value and preserve them.
- Implement bylaw updates in line with resident preferences around development (see next section).

Action Items

[To be filled out based on what Energy Committee and other municipal boards want to take on in the next 3-5 years.]

Action	Lead Entity (or Entities)	Supporting Entities	Start Year/ Annually?

7. MUNICIPAL ZONING, BYLAWS, & PERMITTING

7.1 Current Status

State Law regarding Solar Zoning Bylaws

Local zoning laws are regulated by Massachusetts General Law Chapter 40A Section 3. The section relevant to solar zoning states that "*No zoning ordinance or by-law shall prohibit or unreasonably regulate the installation of solar energy systems or the building of structures that facilitate the collection of solar energy, except where necessary to protect the public health, safety or welfare*." There has been much debate over what constitutes regulations that are necessary to protect public welfare, and whether this might include restrictions imposed to protect environmental or agricultural resources of value to the general public. In a recent case, *Tracer Lane II Realty, LLC v. City of Waltham*, the Massachusetts Supreme Judicial Court ruled that the City of Waltham could not impose a restriction that effectively limited large-scale solar development to no more than 2% of the municipality's area However, it did not address what would be an area reasonable to exclude from large-scale solar development would be. This limitation on local zoning is important to keep in mind when reviewing or updating the town's bylaw. Law firms that commonly work with municipalities recommend basing updates on extensive planning efforts (such as this one) and ensuring that any restriction is grounded in an easily articulated reason related to public health, safety, or welfare. Always check with Town Counsel before implementing any changes.

Municipal Bylaws

Montague's zoning bylaw was updated in February 2019. The solar bylaw is intended to encourage solar energy installations and facilities with minimal environmental impact which are located on roofs, over parking lots, and on degraded sites.

The bylaw categorizes installations by location, size, and purpose.

- Building-mounted solar energy installations are permanently affixed to a building and appear to be permitted by right in all zoning districts with a building permit. Solar parking canopies are included in this category, although not clearly defined.
- Accessory ground-mounted solar energy installations are mounted on the ground or on a non-building structure (supports) and the energy collected is primarily used on-site. These types of systems often require a Special Permit, dependent on size (see **Table 7**).

Zoning District	Requirement
Neighborhood Business, Central Business, and Recreation-Education	Special Permit Required
RS-1	Special Permit Required if exceeding 150 square feet of panel surface area (roughly 2.25 kW)
All other districts	Special Permit Required if exceeding 500 square feet of panel surface area (roughly 7.5 kW)

Table 7. Requirements for ground-mounted solar energy installations by Zoning District.

- "Solar energy installations" are mounted on the ground, occupy more than 2,000 sf (about 30 kW capacity), and primarily serve off-site load. These types of systems are only allowed in Industrial and Historical-Industrial districts with Site Plan Review and a Special Permit.

Solar energy installations require submittal of detailed Site Plans and are subject to numerous requirements regarding lighting, signage, vegetation management, tree removal, and other environmental and aesthetic concerns.

Community Perspectives

Based on the *Community Solar Survey*, residents provided the following information regarding their preferences for town permitting policies and processes relative to solar:

- 67% of residents believe that the development of large, ground mounted solar energy should be allowed and promoted in appropriate circumstances and an additional 17% believe it should be encouraged and promoted generally.
- Residents are interested in having community involvement in planning for large-scale solar energy projects. A majority of respondents want to have information shared at public meetings, and they want to be able to review and comment on the siting and design. They also want to be involved in deciding the best place in town for the solar project and believe voters should have the right to vote on solar projects before they have been approved. Residents want communication with the solar developer, including being able to express concerns directly to the developer. Finally, residents want the opportunity to be a part-owner of the project.
- Residents were especially interested in supporting solar projects when there were certain community benefits attached. These included reduced electricity rates for residents and reduced property taxes. It also helped if a solar installation could provide jobs for residents or back-up power to a school, emergency shelter, or senior housing.
- Residents expressed that they did not know about the process of solar permitting and development. In fact, 56% said they were not sure and/or not aware of the process. However, they did express interest in being more involved in the process and learning more.

7.2 Next Steps & Action Items

As noted above, a majority of residents are unsure or unaware of the solar permitting process in Montague. It would be beneficial to provide information on the town's website and distribute information about the permitting process, perhaps as a part of sharing information about this solar planning process.

Montague's bylaw aligns well with resident preferences in multiple respects, including the streamlining of permitting for rooftop solar, permitting of solar to serve on-site loads, and limitations on large, ground-mounted development. The town's permitting process, in conforming to state Opening Meeting Law, meets residents' desires for information-sharing at public meetings and an opportunity to comment on siting and design of large solar arrays. However, there are some aspects of the bylaw which could be updated to better align with state law, as well as with community preferences as identified in the *Community Solar Survey*, including resident support for a solar goal of community self-sufficiency.

With review by Town Counsel, the town may wish to consider the following updates to the solar bylaw:

Solar Canopies. As noted in Section 2, solar canopies over parking lots may be included in the definition of building-mounted structures, but the language in the bylaw is not clear. Given residents' support for these types of structures, it would be advantageous to clearly include them in the building-mounted solar category, or to add a separate category for these systems, allowing them by right with a building permit in all districts (while perhaps requiring Site Plan Review for systems over a certain size).

Accessory Solar Definition. Accessory ground-mounted solar installations could be better defined. There is no limit on the size of these systems as included in the definition, but the subsequent definition (solar energy facilities) states that it applies to projects over 2,000 sf – perhaps implying that accessory systems are intended to be limited to no more than 2,000 sf. In addition, these systems are intended to "primarily" support on-site electricity needs, but this term could also be better defined – what fraction of the energy must be used on-site? If a business owns multiple properties around town and net-meters energy from the solar facility to another nearby property, could that also be considered accessory use?

The limit on the size of these systems allowed by right is at most 500 sf, and is 0 sf or 150 sf in some districts. Given that residents are supportive of small-scale ground-mounted systems, we recommend allowing these systems by right in all districts, at least up to the largest size needed for residential systems, which would be roughly 1,700 sf or 25 kW.

Introduce "Medium-Scale" Solar. To allow for easier installation of medium-scale ground-mounted systems in the margins of farm fields, adjacent to buildings, along major roads, as solar canopies over parking lots, and in other configurations supported by residents, the town may wish to develop a category for "medium-scale" solar. Many communities allow "medium-scale" solar by right in all districts with Site Plan Review, up to a specified size or area (for example, 250 or 500 kW, or 1 or 2 acres).

Expand Zoning for Large-Scale Solar Installations. Currently, the bylaw suggests that any ground-mounted solar facility over 2,000 sf (30 kW) is prohibited outside of Industrial and Historical Industrial districts. Even if the town introduces a medium-scale solar definition (for projects up to 250 or 500 kW), we still recommend considering expansion of the locations that larger systems (500 kW and above) could be located. The Industrial and Historical Industrial districts take up a relatively small portion of the municipality, and it is possible that this restriction is in conflict with state law. In addition, these districts do not include large areas of electricity transmission ROW, some areas of low conservation value along major roads, and other disturbed sites where survey respondents indicated they would support solar development. If large-scale installations were allowed in most zoning districts, the town would simultaneously want to impose additional restrictions related to placement on forest, wildlife habitat, and agricultural lands – the language of these restrictions could be determined in consultation with UMass, Mass Audubon, local land trusts, and other relevant conservation organizations.

Forest Clearing. The provision that limits clearing of mature trees could be more clearly defined and could be altered to allow for tree clearing with off-site compensatory mitigation. A "mature tree" does not appear to be defined in the bylaw. Requiring

maintaining one mature tree on-site for every tree that is cleared for a solar facility does limit the extent of forest clearing on a particular parcel. However, it does not necessarily succeed in meeting environmental goals of limiting habitat fragmentation and reducing encroachment on mature forest. For example, at a previously disturbed site or forested area adjacent to developed areas, it may be better from an environmental perspective to develop the whole site, rather than retain low-quality forest and develop a second facility elsewhere, which could be sited on higher-quality habitat. Rather than require that half of the mature trees on any individual parcel be retained, the town could allow for off-site compensatory mitigation through preservation of higher-quality forest habitat in other parts of the town (e.g., through a conservation restriction).

Whatever the details of the forest clearing provision, the town may also wish to consider establishing a "lookback" period for tree removal. If no "lookback" is established, a property owner could easily log the majority of a forested property and then sell or lease the property to a solar developer in the subsequent year, without violating the provisions of the bylaw or allowing for town oversight.

Pesticide Use. The restriction in the town's current bylaw on herbicide use may conflict with Massachusetts Department of Agricultural Resources (MDAR) authority over pesticide use. The town may wish to check with Town Counsel.

8. SUMMARY

8.1 Summary

This section provides a summary of the Action Items noted throughout this Plan.

8.2 Plan Review

This plan will be reviewed and updated in [5?] years by the Energy Committee in consultation with the Planning Board, Conservation Commission, and Select Board. Updates will consider progress made since the original plan was developed, and may require revisiting steps of the *Community Planning for Solar* process, including the *Solar Resource & Infrastructure Assessment* and *Community Solar Survey*.

[This timeline is up to the town to decide upon. For guidance in determining an appropriate timeline and revision steps, see the CEE factsheet *Monitoring, Evaluating, and Updating your Community Solar Action Plan* on the Solar Planning toolkit website.]

8.3 Action Items

This section will provide a table of Action Items, summarizing briefly each item, indicating which municipal board, committee, or group of residents is responsible for taking the lead on next steps, and indicating the projected timeline (calendar dates). The table will also include the anticipated timeline for action plan review and revision.

[This list will be drawn from the Next Steps identified above, but town boards and committees will have to identify the timeline over which they want to take it on.]

Appendix A

Table of institutional and commercial roofs over 5,000 sf in area.

Structure/Ownership Status	Street Address	Total Roof Area (sf)	Estimated Technical Solar Potential (kW)
Judd Wire	124 Turnpike Rd	253,121	2,483
Heat Fab	130 Industrial Blvd	141,198	1,385
New England Extrusion, Inc.	Industrial Blvd	101,873	999
Hillside Plastics	262 Millers Falls Rd	71,516	701
Mayhew Steel Products	199 Industrial Blvd	70,105	688
Business Complex: Food City, Walgreens, Aubuchon Hardware	250 Avenue A	65,877	646
LightLife Foods	Rear LightLife Way	59,366	582
Montague Machine Co.	15 Rastallis St	55,830	548
Atlantic Golf & Turf	27 Industrial Blvd	52,367	514
[closed business]	36 Canal Rd	49,771	488
253 Farmacy Recreational Weed Dispensary	253 Millers Falls Rd	29,947	294
JaDuke Center - Performing Arts	110 Industrial Blvd	21,087	154
FirstLight Hydro Facility	15 Cabot St	19,725	144
Turbosteam Manufacturing	161 Industrial Blvd	17,908	130
Business Complex	320 Avenue A	16,883	123
Pioneer Aviation Building (Airport)	40 Industrial Blvd	14,696	107
Rubin's Auto Service	194 Millers Falls Rd	14,612	106
US Geological Survey (Government Building)	1 Migratory Wy	14,251	104
[closed business]	310 Federal St	13,692	100
US Geological Survey (Government Building)	1 Migratory Wy	13,522	98
Office	282 Avenue A	12,397	90
Business Complex	123 Avenue A	12,224	89
Montague Housing Authority Maintenance	41 Sunrise Terrace	12,068	88
Office	241 Millers Fall Rd.	11,696	85
Baystate Health Hospital	8 Burnham St	11,147	81
Office	42A Canal Rd.	10,421	76
Millers Falls Rod & Gun Club	210 Turners Falls Rd.	10,351	75
Business - Manufacturing	26 North Leverett Rd	9,590	70
Firstlight Electricity Generation Facility	26 Power St	9,522	69
Franklin Survival Center	96 4th St	9,079	66
Business - Manufacturing	15 Rod Shop Rd	8,958	65
Business - Manufacturing	10 Industrial Blvd	8,645	63
Business Complex - Restaurants	33 East Main St	8,612	63
JaDuke Theater	110 Industrial Blvd	8,485	62

United Arc	294 Avenue A	8,353	61
Business Complex	107 Avenue A	8,192	60
Kustom AutoBody Garage	48 Randall Rd	8,082	59
Business Complex	76 Avenue A	7,727	56
Business	400 Avenue A	7,720	56
Catholic Church	80 Seventh St	7,555	55
FastLights Lighting	47 J St	7,529	55
Marks Rentals Garage	484 Federal St	7,522	55
Business - Manufacturing	10 Industrial Blvd	7,168	52
Industrial - Firstlight Electricity Generation	0 Avenue A	7,154	52
Church	148 L St	7,134	52
Warehouse - Commercial	7 Rod Shop Rd	7,031	51
Great Falls Discovery Center	2 Avenue A	6,926	50
Medical Offices	Rear Burnham St	6,788	49
Business Complex	104 Avenue A	6,656	48
Business Complex	176 Ripley Rd	6,636	48
Business Complex	161 Avenue A	6,616	48
Shanahan Construction	298 Avenue A	6,575	48
Business Complex	82 Third St	6,486	47
Element Brewing Company	16 Bridge St	6,473	47
Business Complex	Unity St	6,353	46
Church	19 Bridge St	6,107	44
Barn - State DFG	W Chestnut Hill Rd	6,002	44
Barn - Commercial	Rear Montague City Rd	5,991	44
Offices of Dolan & Dolan	170 Avenue A	5,852	43
Social Hall	197 Avenue A	5,713	42
Offices	15 Power St	5,488	40
Business Complex	52 Avenue A	5,442	40
Jarvis Pools & Spas	72 Unity St	5,329	39
Business - Funeral Home	1 Kostanski Sq	5,308	39
Warehouse - Commercial	314 Montague City Rd	5,272	38
Social Hall	1 Elks Ave	5,224	38
Brick & Feather Brewery	320 Avenue A	5,158	38
Church	4 North St	5,148	37
Business - Closed	5 Millers Falls Rd	5,140	37
Country Club/Golf Course	29 Country Club Ln	5,121	37